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"Quand il me sembla que le contour de cette tache touchait le bord du Soleil, ou, pour mieux dire, qu'à peine elle commençait à s'avancer sur ce dernier, le chronomètre marquait

h m s
2 49 31·0, temps moyen de Rome.

"Ce fut là ce que je considérai comme le premier instant du contact extérieur.

"Craignant une illusion, je continuai à y tenir l'œil fixé, mais au bout de 30 secondes environ, l'entaille devenait distincte et certaine, presque un degré plus au Nord que le point établi pour le contact.

"J'attendis encore un peu; et lorsqu'elle fut devenue nettement appréciable, ayant une largeur d'un peu plus de 2″, je marquai l'heure une seconde fois et j'obtins

h m s
2 50 29·7."

Les temps que je viens d'indiquer sont renfermis dans les limites de quelques secondes, à cause de la refraction et surtout à cause de l'ondulation du contour solaire, produite par l'agitation de l'atmosphère. Pour ces mêmes raisons on eut quelque incertitude pour déterminer l'angle de position correspondant au point du bord du Soleil où le contact devait s'effectuer.

Position géographique de l'Observatoire de Moncalieri.

Latitude Nord	=	44° 59′ 51″·3
Longitude West Rome ...	=	4 46 36·8
		h m s 0 19 7·1

On the Observations of the Transit of Venus, 1882, *December* 5–6, *made at the Lick Observatory, Mount Hamilton, California.*

By Professor David P. Todd, M.A.

(*Communicated by W. H. M. Christie.*)

I arrived at the Lick Observatory, on the summit of Mount Hamilton, in the evening of November 21. The Horizontal Photoheliograph—the chief instrument of the Observatory to be employed during the Transit—had been, in the main, mounted and got in readiness before my arrival by Mr. Fraser, and a few preliminary photographs had already been taken by Captain Floyd. It remained to complete the unfinished portions of the instrument, to mount and adjust the same, to modify some

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details of the instrument which had been constructed wrongly, and to make sure of the convenient and effective working of every part.

Especial attention was given to the accurate determination of the position of the focal plane of the objective, and the method adopted—being nothing short of the critical examination, by many persons independently, of several sets of trial plates exposed at varying distances from the objective—finally indicated the setting of the plate-holder true to the $\frac{1}{8000}$th part of its focal length. Great care was taken to prevent the mishap of fogged plates, from scattered and diffused light falling upon the sensitive film during exposure; likewise to insure the perfect definition of the limbs of the Sun and *Venus*, and to produce an image of the Sun on the photographic plates which should be entirely free from abnormal distortion. The wet process was employed in making all the pictures of the Transit, and the photographic operations were in charge of Mr. Lovell.

The Photoheliograph was mainly constructed by Alvan Clark & Sons, and is essentially like those made for the American Transit of *Venus* Commission. A detailed description of these instruments, with plates, is given in Part I. of the American *Observations of the Transit of Venus of* 1874, by Professor Newcomb. The Lick Photoheliograph, like all the others, has an objective five inches in diameter. Its focal length is almost exactly forty feet, or about $\frac{1}{30}$th part greater than the mean focal length of the eight instruments of the Commission. The diameter of the heliostat mirror—an unsilvered glass disk—is a little greater than seven inches. The objective and the mirror were mounted on two adjacent piers, and the plate-holder on a third pier coming up in the interior of the photographic house. These piers were all set in the meridian of the Transit Instrument, and were laid up of brick, their foundation being in the rock of the mountain summit.

The conditions of weather during the two weeks preceding the day of the Transit were, in general, very favourable for the work of preparation. No snow fell, and on only two days were there any rains—these very slight. Violent winds interfered with our operations on three or four days. The temperature was rarely below 50° and most of the time above 60°. At midnight, November 30, the sky cleared, after three and a half days of continuously cloudy weather. From that time until the afternoon of December 7 we saw no cloud, day nor night, which could interfere in the least with any observation we had to make. Thin cirrus was floating above the summit on the morning of the 2nd, but it had vanished completely within two hours; and on three or four occasions clouds were observed near the horizon, but they never rose. The wind blew in fitful gusts night and day the 3rd and 4th, and the morning of the 5th. But very soon after 12 o'clock that day the winds entirely subsided, and for the next fifty or sixty hours the utmost tranquillity prevailed,

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the temperature never falling below 60°, and rising to very near 70° in the shade at noon on the day of the Transit.

The Sun rose about 7 o'clock, December 6, with *Venus* a good way on its disk. The planet was observed by Captain Floyd at intervals throughout the time of the Transit, with the 12-inch Equatorial of the Observatory; and with this instrument he made several drawings, and observed the two contacts at egress. These were observed also by myself with the 4-inch Transit Instrument, mounted on its reversing carriage.

The first photograph of the Transit of *Venus* was taken December 5, $19^{\rm h}\ 11^{\rm m}$, local mean time. The exposure was $1\frac{1}{2}^{\rm s}$ long, and the slit $3^{\rm in}\cdot 0$ wide. Only a very faint image came out on the plate. The fourth exposure, somewhat shorter, and with the slit the same width, gave, at $19^{\rm h}\ 17^{\rm m}$, a picture sufficiently intense for measurement; but the vertical diameter was about $\frac{1}{18}$th part, or $\frac{1}{4}$ of an inch, shorter than the horizontal one, and the limb was not well defined. Plate No. 13, at $19^{\rm h}\ 50^{\rm m}$, slit $1^{\rm in}\cdot 0$ in width, and exposure $0^{\rm s}\cdot 4$ long, is the first photograph of real value, though the five immediately preceding it may be worth measuring. The width of the slit was gradually reduced as the altitude of the Sun increased, being successively $0^{\rm in}\cdot 75$, $0^{\rm in}\cdot 5$, and $\frac{3}{8}$ inch, until at $21^{\rm h}\ 20^{\rm m}$ it was set at a width of $0^{\rm in}\cdot 25$, and so kept until the end. The exposures were quite uniformly $0^{\rm s}\cdot 25$ in length.

Thirteen reversals of the plumb-line were made during the period of the exposures. The exposing-slide was moved to the east and to the west alternately with each exposure. The temperature of the photographic house—in which there was no fire—was frequently read from a standard thermometer, the range being from 65°·7 at $19^{\rm h}\ 51^{\rm m}$, to 75°·4 at $23^{\rm h}\ 38^{\rm m}$. This latter was the time of the last exposure preceding interior contact at egress. After I had observed this contact optically, the exposures were resumed, and ten additional photographs were made. The total number of plates exposed was 147. Subtracting from this number all those exposed at the beginning of the day, the ten made between the two contacts at egress, a few worthless ones, and all others of doubtful value, the total number of plates available for micrometric measurement cannot fall far short of 125, and may somewhat exceed that number.

Before the plates were finally packed in boxes I made a comparative estimate, based on a somewhat rapid examination, of the value of these photographs of the Transit. Each plate was taken up in order and a mark assigned to it on the scale *A*, *A*—, *B*+, *B*, *B*—. The mark *A* means that the plate was judged to be of the very first quality, and capable of the most accurate measurement. Those marked *A*— are a shade inferior. Second-grade plates are designated by *B*; those a shade better, but not so good as *A*—, being marked *B*+; while those not up to the grade *B* are marked *B*—. A few were judged to be worth only a still lower mark, *C*. The result was as follows:—

A	71
A−	23
B+	13
B	9
B−	3
C	4
Total	123

After I had satisfied myself that no better place than the Observatory vault could be found for the temporary storage of these plates, they were, in great part, deposited there, together with such portions of the Photoheliograph as have yet to be investigated before the reductions of the photographic measurements can be completed. A few of the plates were brought to San Francisco, and placed in the vaults of the Safe Deposit Company of that city. The original record of the photographs was left in the Observatory vault on the mountain, duplicate and triplicate copies of it having been carefully prepared and brought down for preservation elsewhere.

Lawrence Observatory, Amherst, Mass.:
1883, *Jan.* 24.

Observations of the Transit of Venus, 1882, *Dec.* 6, *made at Mells, Ten Miles South of Bath.* By Maures Horner.

Instruments used:

A five-inch Equatorial Refractor, by Cooke, 1864, with position circle and clockwork.

A spectroscope of two prisms, dispersion about 15°, by Hilger; iridium slit shutting without spring, with milled head graduated to 1-900th of an inch. Prisms set to between C and D.

Sidereal time obtained from *α Cygni* by Troughton and Simms' portable transit instrument in conjunction with a Cooke pendulum-clock shortly after sunset.

The morning of the 6th was not quite without hope, for although the clouds appeared heavy, yet the wind kept nearly due north and the temperature low. At noon signs of a breaking in the sky became visible. All preparations were made, and some glimpses of the Sun obtained. The spectroscope was fixed, and the slit, 1-100th of an inch open, adjusted by means of the position circle tangentially as near to 145° as possible. At 1·30 G.M.T. the chromosphere was fairly well observed. Two small protuberances marked out the field of view; the larger one seemed to have rather a filamentary structure, and the space between appeared uneven, but not very active. At the place